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ATTACHMENT

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| Examiner Lun S. Lao | U.S.P.T.O. | 571-273-7501 | 571-272-7501 |

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| **From** | Stacy L. Blasberg | **Number of Pages** | 2 |
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**Comments** Examiner Lao,

As per your request, I have attached a clear copy of the equation that was submitted with the originally-filed specification at page 8, line 20 for Patent Application No. 09/197,096. Please let me know if you need anything further.

Thank you,
Stacy Blasberg
Patent Attorney Registration No. 52,625

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In general, any nonlinear circuit without memory has a voltage transfer characteristic $v_{out}=g(v_{in})$ that can be written as a power series

$$g(V_{in}) = \sum_{n=1}^{\infty} a_n v_{in}^{\,n}$$ ← (the space item of line 20.)

If a sinusoid of frequency $f_0$ is applied to the network, each $v_{in}^{\,n}$ term creates a harmonic $nf_0$, plus other lower order terms. Hence the harmonic spectrum is governed by the coefficients in the power series. Transfer characteristics with sharp discontinuities will have a power series with large amplitudes of high order terms, creating considerable high frequency distortion products. Thus, the distortion properties are directly related to the smoothness of $g(v_{in})$. For guitar distortion, where the goal is to increase sustain and compress the dynamic range, $g(v_{in})$ has a compressive characteristic which has a large slope for $v_{in}=0$ and reduces to a small value for large positive or negative values of $v_{in}$. Smooth distortion characteristics are desirable for music such as rhythm and blues, whereas transfer curves with sharper transitions and flatter compression (very low derivatives for large $|v_{in}|$) are more desirable for rock music where higher harmonic content is required.

2) Control of intermodulation. Most circuits do not provide independent control of intermodulation. There are, however, two ways of achieving this.

i) If the guitar has a hexaphonic pickup, each string may be distorted separately, which produces no intermodulation between strings. However, the sound is musically uninteresting, and the output level is dependent on the number of strings played. By allowing controlled mixing of the separate string signals before the distortion circuits, the